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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/784,017	02/20/2004	Bruno Ghyselen	4717-10200	2491

28765 7590 02/03/2006

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EXAMINER

AU, BACH

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 02/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 10/784,017	Applicant(s) GHYSELEN ET AL.	
	Examiner Bac H. Au	Art Unit 2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 November 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 November 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO 1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>2/20/04, 11/18/05</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. Applicant's amendment dated November 18, 2005 in which claims 1, 6, 12, and 22 were amended has been entered.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation "the strained silicon layer" in line 5. There is insufficient antecedent basis for this limitation in the claim. It is unclear whether "the strained silicon layer" is a different layer from the "strained semiconductor layer" in line

3. For the purpose of this Office Action, the limitation is treated as the same layer and that the limitation should be re-written as --the strained semiconductor layer--.

The remaining claims are rejected based on their dependency.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-8, 11-16, and 18-24 are rejected under 35 U.S.C. 102(e) as being anticipated by Notsu (U.S. Pat. 6828214).

Regarding Claim 1, Notsu [Figs.1A-2B] discloses a method for forming a relaxed or pseudo-relaxed useful layer [14'] on a substrate which comprises:

growing a strained semiconductor layer [14 of Fig 1A; layer 14 (SiGe) is inherently strained due to mismatch of lattice constants with the layer 13 (Si) below] on a donor substrate [11 of Fig 1A] at a thickness that remains below a critical resilient strain thickness which would otherwise cause strain relaxation or an appearance of internal plastic deformations in the strained semiconductor layer [Specification, p.7 lines 2-5, indicates this thickness to be preferably between 200Å and 500Å (20-50nm); Notsu col.9 lines 44-46 discloses a SiGe layer 14' thickness of 5 to 50nm];

bonding a receiver substrate [31 of Fig 1C] to the strained semiconductor layer by a vitreous layer [21 of Fig 1C] of a material that becomes viscous at a certain viscosity temperature of above about 900°C to form a first structure [Per specification, page 7 lines 26-31, the viscosity temperature of SiO₂ (vitreous layer) is around 1150°C. Notsu discloses the material of the vitreous layer to be SiO₂.];

detaching the donor substrate [11 of Fig 1D] from the first structure to form a second structure [30' of Fig 1D] comprising the receiver substrate [31 of 1D], vitreous layer [21 Fig 1D], and the strained layer [14 of Fig 1D];

heat treating the second structure [Fig.1E; column 9, lines 19-24] at a temperature and time sufficient to relax strains in the strained semiconductor layer and to form a relaxed or pseudo-relaxed useful layer [14' of Fig 1E] on the receiver substrate.

Regarding claims 2 and 3, Fig 1C of Notsu discloses the vitreous layer being formed on the strained layer [21], as well as being formed on the receiver substrate [32] prior to bonding.

Regarding claim 4, Notsu discloses wherein the second structure is heat treated at a temperature that is at least about the certain viscosity temperature [Fig. 1E; column 9, lines 19-24].

Regarding claims 5-6, Notsu [Figs 1A and 1B, column 8, lines 11-28] discloses wherein the vitreous layer [21] is provided by growing a semiconductor material [15] on the strained layer [14] and applying a controlled treatment to convert at least part of the semiconductor material layer into a material which is viscous above the certain viscosity temperature. Notsu also discloses the semiconductor material layer [15] comprises silicon, and the controlled treatment is a controlled thermal oxidation treatment that converts at least part of the silicon layer into the vitreous layer as a silicon oxide vitreous layer [21].

Regarding claim 7, Notsu [15' of Fig 1B] discloses wherein the controlled treatment forms an inserted layer between the vitreous layer and the strained layer.

Regarding claim 8, Notsu discloses [Column 9, line 65 - column 10, line 5] wherein the inserted layer [15'] becomes at least a partially strained layer after the treatment.

Regarding claim 11, Notsu [41 of Fig 2B; column 10, lines 13-15] discloses growing a strained semiconductor layer on the useful layer.

Regarding claims 12-13, Notsu [32 of Fig 1C; column 8, lines 60-62] discloses applying a bonding layer of material onto at least one of the vitreous layer, the receiver substrate or the strained layer prior to bonding the receiver substrate to the strained semiconductor layer; and wherein the bonding layer comprises silicon oxide.

Regarding claims 14-16, Notsu discloses a zone of weakness [12 of Fig 1A] in the donor substrate so that the donor substrate can be detached along the zone of weakness [Fig 1D]. Notsu [Column 6, lines 57-65; column 7, lines 6-7] discloses wherein the donor substrate is fabricated by forming a porous layer on a crystalline carrier substrate and growing a crystalline layer on the porous layer comprises the zone of weakness of the donor substrate. Notsu [Column 9, lines 4-11] discloses wherein the donor substrate is detached along the weakened zone by at least one of chemical etching or mechano-chemical etching.

Regarding claim 18, Notsu [Fig 1D] discloses wherein the donor substrate is detached along the zone of weakness to form a third structure [30'] comprising the receiver substrate [31], the vitreous layer [21,32], the strained layer [14], and a layer of

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donor material [12'], and wherein the layer of donor material is removed [Fig 1E; column 9, lines 12-16] before heat treating the third structure.

Regarding claims 19-21, Notsu [Figs 1A and 1B] discloses wherein the vitreous layer is of an insulating material [21]; wherein the vitreous layer comprises silicon oxide [column 8, lines 18-24]; wherein the donor substrate comprises silicon [11] and the strained layer is made of a $\text{Si}_{1-x}\text{Ge}_x$ material [14] [column 6, lines 51-56].

Regarding claim 22, Notsu [column 9, lines 60-65] discloses the heat treating occurs at a temperature above about 900°C to about 1500°C.

Regarding claims 23-24, Notsu [column 14, lines 29-32] discloses method of fabricating optic, electronic or optoelectronic components in the useful layer; as well as method of fabricating optic, electronic or optoelectronic components in the strained semiconductor layer.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Notsu (U.S. Pat. 6828214) in view of Stecher (U.S. Pat. 6873012).

Regarding Claims 9 and 10, Notsu fails to disclose wherein the thickness of the vitreous layer in the first structure is about between 5Å and about 5000 Å; wherein the

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thickness of the vitreous layer is about between 100Å and about 1000Å. However, Stecher [Column 1, lines 58-63] discloses “an insulation layer having a thickness of up to 1µm”.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teachings of Stecher into the method of Notsu to use an insulation layer of thickness about between 100Å and 1000Å. The ordinary artisan would have been motivated to modify Notsu in the manner set forth above for at least the purpose of obtaining increased dielectric strength [Stecher, column1, lines 58-63].

5. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Notsu (U.S. Pat. 6828214) in view of Henley (U.S. Pub. 2003/0113983).

Notsu fails to disclose wherein the zone of weakness is formed by implanting atomic species in the donor substrate. However, Henley [Paragraph 27, lines 1-2, 28-33] discloses “particles are implanted ... such as hydrogen, helium...”.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teachings of Henley into the method of Notsu to form the zone of weakness by implanting atomic species. The ordinary artisan would have been motivated to modify Notsu in the manner set forth above for at least the purpose of more precise location of weakness zone on the substrate as well as reducing the energy required in the separation step [Henley, paragraph 32, lines 1-8].

Response to Arguments

6. Applicant's arguments filed November 18, 2005 have been fully considered but they are not persuasive. Applicant amended claim 1 to include the limitations of a critical resilient strain thickness of the strained semiconductor layer as well as the vitreous layer of a material having a certain viscosity temperature of above about 900°C. Both of these elements have been addressed fully in the rejection above of claim 1. Applicant asserts that Notsu does not form a strained layer until after the bonding and separation steps followed by annealing. As stated above, layer 14 of fig.1A (SiGe) is inherently strained due to mismatch of lattice constants with the layer 13 (Si) below. Thus, a strained layer does exist prior to the bonding step. Assuming *arguendo* that the strained layer is only formed after the annealing, Notsu [Col.12 line 65 – col.13 line 5] discloses the annealing can be done prior to bonding and separation. Since these elements are fully addressed with regards to Notsu, the combination of Notsu with Stecher and Henley for dependent claims 9-10, and 17 is upheld.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

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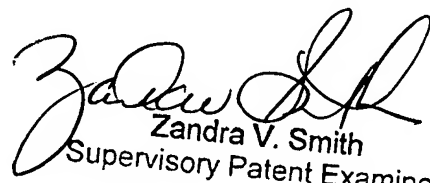
shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bac H. Au whose telephone number is 571-272-8795. The examiner can normally be reached on Mon-Fri 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on 571-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

BHA


Zandra V. Smith
Supervisory Patent Examiner
26 Jan 2006